RESULTS OF INDOOR AIR QUALITY INVESTIGATION

NAVAL SEA SYSTEM COMMAND

WASHINGTON NAVY YARD

BUILDING 22

CONDUCTED FOR:

NAVSEA

OCTOBER 2001

ADVANCED ENVIRONMENTAL SERVICES, INC.

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EXECUTIVE SUMMARY

Naval Sea System Command (NAVSEA) issued a contract to Advanced Environmental Services, Inc. (AESI) for a baseline indoor air quality study at some of their buildings at the Navy Yard, Washington.

During the week of September 3-7, 2001, Dr. David Anderson of AESI toured the facilities and conducted preliminary baseline sampling. The facilities, for the most part, were recently remodeled and occupied by NAVSEA personnel, transferring in from Crystal City, Virginia. Some of these buildings were listed as historical sites.

Building 22 was occupied during the initial visit by AESI in October 2000 in relationship to another project. The building is used by both NAVSEA personnel and other Navy personnel; essentially, it is a shell formed by using a four- story metal building installed inside an old historic building with; the metal building makes up offices.

During the inspection of Building 22, sampling was conducted on September 5, 2001; visible mold was present in storage closets along the West side of the First Floor. Visible mold was initially noted during the preliminary tour of October 2000.

A total of thirteen (13) samples were collected - eleven (11) air samples and two (2) swab samples of visible mold. The air samples were collected for mold using both Petri dishes (for viable organisms) and Zefon™ Air-O-Cell cassettes for total, non-viable airborne organisms; in addition, two (2) samples were collected for total Volatile Organic Chemicals (VOCs) in the air. The samples were sealed and shipped via Fed Ex to an outside microbiological lab. The preliminary results were received via fax in September, with the final results received via mail in October. *Stachybotrys* was found on a bulk sample, but not in the air.

Outside the air results were found to be high at 1,973 Counts per Cubic Meter of Air for total spores and 625 Colony Forming Units per Cubic Meter of Air (CFU / M^3) of viable spores.

Air samples collected from inside Building 22 were lower than the outside air. The samples taken from the Mechanical Room, Third Floor, were reported to contain 347 Counts per Cubic Meter.

The second highest level found was in the Events Support section at 93 Counts per Cubic Meter of Air. Tied for third highest were the Tech Support Room and the Electric Vault at 80 Counts per Cubic Meter of Air.

Fifth highest was the area around Office 402 at 40 Counts, followed by the area around 417 at 13 Counts. A Petri dish sample around 417 also revealed 13 CFU / M^3.

At Office 417, at sample was also collected for VOCs. Only two (2) organic compounds were identified – but at low (micrograms of organic material per Cubic Meter of Air) concentrations; those were 2-propanol and acetone.

A VOC sample was also collected in the Events Support Section. As before, there were only two (2) compounds identified – the same two chemicals – but at even lower concentrations.

In addition, two (2) bulk samples were collected using swabs. The sample collected from the HVAC register in the 403 Office did not find mold present. The swab collected from the Southwest storage closet, first floor, was reported by the lab to contain 5 - 25 % *Stachybotrys* and 5 – 25 % *Pithomyces*.

A fax was sent to Mr. Michael Smith, COTR, with the preliminary data on September 24, 2001. It indicated the presence of *Stachybotrys* and suggested the area on the first floor around the storage closets be isolated.

The Navy requested additional testing to determine if contamination levels had spread. A second trip and more extensive sampling was conducted during September 26 to 28, 2001.

On September 27, a total of seven (7) samples were collected in Building 22– five (5) air samples and two (2) swab samples. On the first floor, no containment had been erected; the closets were locked, however.

Outside, the level was reported to be 1,813 Counts per Cubic Meter of Air. The highest level in the air was tied at 80 Counts each in the Southwest Closet and the Northwest Closet, including *Stachybotrys* in the Southwest Closet.

The Center section of the Multi-Purpose room was reported to be 40 Counts, followed by the Center Closet, West side at 13 Counts.

Swabs taken from visible mold in the Southwest Closet both revealed *Stachybotrys*; the South wall had 5 – 25 % and the North Wall had 25 – 75 %; four (4) other species were also identified.

It appears that the mold levels are not within the guidelines currently used and *Stachybotrys* has been identified in the air and on bulk samples on the First Floor. Remediation is warranted. Following remediation, clearance sampling should be conducted by or under the direction of a Certified Industrial Hygienist prior to reconstruction to verify successful abatement.

The report is based on information available to us at this time. No other aspects if indoor air quality (IAQ) were examined. AESI reserves the right to revise, supplement, and otherwise amend our opinions and conclusions, if necessary and warranted by the discovery of new or additional information.

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Introduction, Methodologies, and Observations

Naval Sea System Command (NAVSEA) issued a contract to Advanced Environmental Services, Inc. (AESI) for a baseline indoor air quality study at some of their buildings at the Navy Yard, Washington.

The purpose of the visit was to conduct a visual inspection of the interior, to collect airborne and bulk samples to establish a baseline for Indoor Air Quality measurements, to determine if a possible health risk was present and to recommend appropriate corrective actions.

The investigation was conducted in accordance with the recommendations and guidelines of the American Conference of Governmental Industrial Hygienists (ACGIH), the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE), the Occupational Safety and Health Administration (OSHA), the National Institute for Occupational Safety and Health (NIOSH), the Environmental Protection Agency (EPA), and established industry standards.

During the week of September 3-7, 2001, Dr. David Anderson of AESI toured the facilities and conducted preliminary baseline sampling with the assistance of the COTR, Michael Smith.

The facilities were initially toured in October 2000, in conjunction with another project. Mold and lead-based paint abatement were noted at that time. Sampling equipment was not available at this time, nor was sampling requested. A four-story metal building had been built inside a historical building – Building 22, and was occupied. On the roof of the "new" building, bird droppings, paint chips, and standing water was observed; a bird was using the water for a bath. Containment for the lead-based paint abatement had come partially loose on the South end. In addition, the Mechanical Room, also being used for storage, was noted to have openings running the entire length and height of the building, providing access for contaminants from other portions of the building to enter the new building. Please refer to Appendix E for selected pictures taken on this visit.

For the purposes of this report, the building runs North to South, with the primary entrance on the North, and is four (4) stories tall. NAVSEA personnel occupy this building in conjunction with other Navy personnel.

Outside, the weather was sunny and in the low 80's. Inside, the air conditioner was on; temperature and humidity varied by location. A TSI IAQ monitor was used to measure temperature, relative humidity, carbon monoxide (CO) and carbon dioxide (CO_2); there were fairly substantial differences found; these are expressed in Table I.

Table I – Environmental Field Data

Location	Temperature (F)	Humidity (%)	CO	CO_2
417	72.9	59.2	0	510
Events Staff	73.8	51.8	0	398
Electric Vault	77.4	45.7	0	478
Electric	72.7	51	0	472
Tech Support	74.1	50.4	0	425 - 500

Visible mold was discovered on the walls in the Southwest Closet of the First Floor of the Multi-Purpose Room. As mentioned, this had been observed approximately one (1) year earlier. The Center closet was unlocked, but no mold was noted. The Northwest Closet was opened, but metal frames were seen stacked from the floor to almost to the ceiling. (Please refer to Appendix D for pictures). Neither walls nor visible mold could be seen.

A total of thirteen (13) samples were collected - eleven (11) air samples and two (2) swab samples of visible mold. The air samples were collected for mold using both Petri dishes (for viable organisms) and Zefon™ Air-O-Cell cassettes for total, non-viable airborne organisms; in addition, two (2) samples were collected for total Volatile Organic Compounds (VOCs).

Zefon™ Air-O-Cell cassettes are used for total, non-viable airborne organisms. (For specific locations, please refer to Appendix A). Air-O-Cell cassettes collect samples for total organisms – both living (viable) and non-living (non-viable). The sampling pumps had been calibrated prior to arrival using a rotameter. These samples provide information on total fungal colony Counts per Cubic Meter (Counts / M^3).

Petri Dish samples were also collected at some of the same locations as two of the Cassette samples. The A-6 bioaerosol monitor, used to collect samples onto the Petri dish, was disinfected on-site using isopropyl alcohol. The air-sampling pump had been calibrated prior to the visit for the type of collection media using a standard method – wet test meter, followed by a rotameter.

The sample collected in the Petri, which contained Potato Dextrose Agar (PDA) media; this allows for both cultivation and differentiation of spores, i.e. "viable" or live. Following incubation, the samples are analyzed via light microscopy at 600X magnification, and the data are reported in numbers of Colony Forming Units per Cubic Meter of air (CFU / M^3), as well as the specific genus types, such as *Aspergillus* and *Penicillium.* (Plates were shipped to the lab inside ice chests to minimize growth between collection and laboratory-controlled incubation).

In addition, two (2) bulk (swab) samples were also collected. The "swab" method uses a Sterile BBL Culture Swab collected over an approximately one hundred square centimeter surface area; the swab is placed into a plastic holder containing agar, sealed and labeled.

Two (2) samples for Volatile Organic Compounds (VOCs) were also collected. This sample device used a 400 milliliter evacuated flask equipped with a flow-limiting orifice. Once activated, air was drawn into the prepared flask; following the sampling time, the flask was sealed. Upon arrival at the lab, the flask was purged and contents injected into a gas chromatograph equipped with a mass spectrometer; a total of sixty three (63) different organic compounds were analyzed for each VOC sample collected.

All samples were sealed and shipped via Fed-Ex to an outside, independent microbiological lab that specialized in identification and analyses of these types of samples; in addition, they also participate in an Environmental Microbiological Proficiency Analytical Testing (EMPAT) quality control program administered by the American Industrial Hygiene Association, designed for maximum quality and control. An affiliate lab that is Accredited by the American Industrial Hygiene Association analyzed the organic materials. Chain-of-Custody forms were maintained.

A Tramex moisture meter was used to measure moisture in the floors and walls. Excessive moisture was not found, indicating the moisture had been eliminated.

In the Tech Support section, stained ceiling tiles were noted; these stains either came from the lead-based paint abatement conducted the previous year, or from a more recent test of the fire water system. The personnel in this area were concerned about lead-based paint above their drop-tile ceiling. Stains were also still present in the First Floor ceiling tile. In the Events Staff area, the employees complained of eye irritation, which had been on-going for several months.

The preliminary results for the samples were received via fax, followed by mail. (Appendix B, sample numbers 1-13). A fax was sent to NAVSEA with the preliminary data on September 24, 2001. Containment along the West side of the First Floor was recommended. Following this, the contract was modified to allow for additional sampling with expedited results.

This second trip occurred September 26 to 28, 2001. Building 22, First Floor was monitored again on September 27. Outside, the weather was sunny and 65 degrees; inside the temperature and humidity were approximately the same as before. On that date no containment was noted; the closet doors were locked.
A total of seven (7) samples were collected – five (5) air samples and two (2) swab samples. The areas of concern were closets adjacent to and the Multi-Purpose Room; these closets were locked, but not sealed in plastic. *Stachybotrys* was found both in the air and on bulk samples collected.

Outside, the airborne level was elevated at 1,813 Counts per Cubic Meter of Air. No inside air samples met or exceeded this level.

On the first floor, two (2) air samples inside the storage closets tied for the highest levels at 80 Counts. The Southwest Corner Closet (adjacent to Joe Anderson's desk) had 80 Counts and the Northwest Corner (where light fixtures were stacked floor to ceiling), the level was also 80 Counts – 50 % of which was *Stachybotrys*.

The Center Storage Closet air sample only found 13 Counts.

In the Multi-Purpose Room, towards the Center of the Room, the air sample revealed 53 Counts.

Two (2) bulk samples of visible mold were collected using swabs inside the Southwest Storage Closet. Both samples revealed the presence of *Stachybotrys*.

Moisture checks revealed elevated moisture levels were not present on all accessible walls in the Closet areas.

RESULTS AND DISCUSSION

TOXICOLOGICAL AND HEALTH EFFECTS

BIOAEROSOLS:

Bioaerosols include any biological agent, which becomes airborne. Bioaerosols may include pollens, animal dander, bacteria, as well as fungi. Because fungi are spore-bearing organisms, which are ideally suited for airborne transport, they often produce symptoms of discomfort among certain individuals.

Fungi originally were considered as a group of plants lacking any stems leaves or roots. Consequently, they were classified along with algae and the lichens. Fungi differed from those groups, however, in their lack of chlorophyll. Fungi exist as parasites (plant, animal and human pathogens) or as saprophytes (decomposers of non-living organic matter).

There are currently about 80,000 described species of fungi, both yeasts and molds, with probably more species awaiting discovery. Fungi are beneficial as food, as producers of antibiotics, as fermenting agents, as sources of drugs, as well as in many aspects of industry. Fungi are also well documented for their role in allergy.

Those fungi most responsible for causing allergy include species belonging to *Alternaria, Cladosporium, Aspergillus, Drechslera, Fusarium, Phoma, Epicoccum, Penicillium, Rhizopus, Mucor, Aureobasidiurn pullulans, Nigrospora, Scopulariopsis* and spores of rusts and smuts. *Cladosporium* is the most common fungus found in the air, followed by *Alternaria, Penicillium,*

Aspergillus, Fusarium, and Aureobasidium pullulans. Clinically, the causative allergenic agents for most persons sensitive to fungi are *Cladosporium* and *Alternaria.*

Aspergillus, Penicillium, Rhizopus, Mucor, Fusarium and *Cladosporium* are examples of fungi that can produce a large number of spores. As they are present at all times in both the indoor and outdoor environments and are an important factor in the production of allergy in susceptible individuals.

Although fungi may grow and produce spores in the water and soil, dead organic debris is considered the main repository for aerobic fungi. Fungal spores will disperse from leaf litter, decaying plant material and other available organic substrata into the air and then fall onto vegetation where they may cause disease; are carried into homes and offices where they may cause moldy bathrooms and basements; and inhaled by humans and animals where they may cause toxic reactions, disease, an allergy, or other fungal disorders; fall onto leather, wood, or food, causing various mold damage; or fall back to or sail onto other supportive materials and repeat the cycle. In any case, fungi cannot produce their own food and therefore must find a source of organic matter in order to survive. High humidity is also necessary for fungal growth and spore germination.

It is important to note that airborne fungal spores must be viable to produce disease or to grow and germinate, but they do not have to be viable to produce allergenic effects in sensitive people. Although a bright sunny afternoon might substantially reduce the viability of fungal spores in the air, it will not bring relief to persons suffering from fungal allergy. There is some indication that the occupants of this residence may currently suffer from this allergic reaction.

Fungal spores are always present in the air, with rain and snow washing down most from the air, and the wind and sunshine causing an increase in the atmospheric distribution of spores. The number of airborne fungi is lowest during the winter months and highest during the summer and autumn months, when dead organic debris is more plentiful.

From the compilation of numerous data, the following distribution indicates the majority and frequency of fungal organisms typically isolated in indoor environments:

Organism	Per Cent
Cladosporium	100
Penicillium	91
Alternaria	87
Epicoccum	53
Aspergillus sp.	49
Aureobasidium	44
Drechslera	38
Acremonium	36
Fusarium	25
Aspergillus niger	19
Rhizopus	13

Possible health effects associated with fungi generally fall into one of three groups:

1. Allergic: sensitization and immune responses such as allergic rhinitis (hay fever), asthma, or hypersensitivity pneumonitis.
2. Infectious: growth of the fungus in or on the body, as with aspergillosis or histoplasmosis
3. Toxic: disruption of cellular function and interaction with DNA, as occurs with toxigenic effects, including aflatoxin-induced cancer.

Mycotoxins exert their effect on organisms in many ways including interference with cellular respiration, interference with carbohydrate and lipid metabolism, and direct binding with DNA and RNA. Several trichothecene mycotoxins are produced by *Stachybotrys*, and both *Aspergillus* and *Penicillium* can produce ocharatoxin A. (For detailed explanations, please refer to Appendix C).

STACHYBOTRYS HEALTH EFFECTS

Stachybotrys atra (SA) can produce several toxic chemicals called trichothecene mycotoxins. These mycotoxins are known to be toxic to both humans and farm animals exposed to significant quantities. Initially the toxic effects of the mold were seen in farm animals that had eaten contaminated hay or grain. Farm workers also experienced health effects (dermatitis, blood and immune system disorders) from handling contaminated material. A recent evaluation of several tricothecenes by the International Agency for Research on Cancer (IARC) found no evidence that they cause cancer.

There have been only a few documented cases of health problems from indoor exposure to SA. In general, the intensity of exposure and health effects from SA in the indoor environment is much less severe than those, which were experienced by farm animals and workers.

If SA spores are released into the air, there is a potential for allergic, respiratory or immunologic symptoms to develop or become exacerbated. These conditions include: asthma, hypersensitivity pneumonitis, allergic rhinitis, dermatitis, sinusitis and conjunctivitis. It is thought that these diseases are mediated by an immune response to SA (or other environmental agents). Many of the related symptoms are non-specific, but debilitating, such as discomfort, inability to concentrate and fatigue. Presently, it is not known whether long-term indoor exposure to airborne SA increases the risk of certain chronic respiratory diseases. In one reported case of indoor exposure, residents experienced cold and flu symptoms, diarrhea, headaches, fatigue, rashes and other symptoms. These symptoms disappeared after all of the contaminated ductwork, insulation, and ceiling material was replaced.

ASSOCIATION BETWEEN SA IN BUILDINGS AND HEALTH EFFECTS

Health risk cannot be predicted based simply on the presence of SA in building materials as indicated by sampling results. In order for humans to be exposed indoors, spores must be released into the air and inhaled. Also, it appears that the symptoms listed above are not likely to develop in all persons exposed at levels likely to be found in buildings. The attack rate (percentage of persons who develop symptoms) is generally low. At the present time, "safe" (or "unsafe") exposure levels have not been established.

INTERPRETATIVE GUIDELINES

Previous research and test data have revealed that indoor airborne spore levels of 30 % to 70 % of the outdoor spore levels are normal, with the same general distribution of spore types. Filtered air, air-conditioned air, or air remote from outside sources may average 5 to 15 % of the outside air at the time of sampling. Based on these guidelines, a residence with open doors and windows and heavy foot traffic may average 135 % of the outdoor level while a high rise office building with little air exchange may average 2 %. In addition, dusty interiors may exceed 100 % of the outdoors to some degree, but will still mirror the outdoor distribution of spore types. Dusty conditions were not noted.

Data collected by the National Institute for Occupational Safety and Health (NIOSH) collectively suggest that a level of 1,000 total colony-forming units (cfu) per cubic meter of air (M^3) may warrant investigation and remedial action. The American Conference of Governmental Industrial Hygienists (ACGIH) Committee on Bioaerosols suggests that the indoor air-borne fungal spore concentration, either in Colony Forming Units or as Countable organisms, should not exceed 30 % of the outside levels and that the indoor level should be qualitatively similar to the outside level; currently there is no TLV for mold. During the growing season, according to the OSHA Technical Manual, levels of outdoor airborne fungal spore levels can range from 1,000 to 100,000 cfu/M^3. This reference goes on to indicate that airborne contaminant indicators are 1,000 cfu/M^3, but that levels above this do not necessarily imply that the conditions are unsafe or hazardous. Risk management investigation should be initiated if the following species are confirmed to be present:

Stachybotrys, Aspergillus versicolor, Aspergillus flavus, Aspergillus fumigatus, and / or *Fusarium moniforme.*

In April 2000, the Indoor Air Quality Association published "Recommended Guidelines for Indoor Environments" (IAQA 01-2000). In this document, their recommendation for culturable (viable) fungal bioaerosols was 300 cfu/M^3 for total and 50 cfu/M^3 for individual fungal spores, excluding *Cladosporium*.

Currently in the United States, IAQ issues are not regulated by a governmental agency. The ACGIH recommends gathering the best data possible and using knowledge, experience, expert opinion, logic, and common sense interpretation of current information. As stated earlier, microbiological species present in the indoor environment should be generally representative of the species in the outdoor environment to a significantly lesser degree. The indoor air samples should not contain specific identifiable pathogenic microbiological organisms.

AIR-O-CELL RESULTS:

The Air-O-Cell Cassette is a unique sampling device designed for the rapid collection and analysis of a wide range of airborne particles, including fungal spores. Air is drawn through a sampling cassette that contains a small, greased microscopic slide; the samples are analyzed via light microscopy at 600X magnification, with the entire slide (100% of the sample) being analyzed. The results are reported as **total**, meaning they include both viable (i.e., living) and non-viable fungal spores. This technique does not allow for the differentiation between *Aspergillus* and *Penicillium* spores, due to the small size. Small spherical fungal spores that cannot be identified and may include *Aspergillus*, *Penicillium*, and *Trichoderma* are grouped together as *Amerospores.* Additionally it does not allow for cultivation or speciation of spores. Typically the results from this collection and analysis method are higher than the Petri dish method, as <u>all</u> spores are collected and counted.

The sample results produced by the lab were received initially by fax and final copies via mail (Appendix B).

SEPTEMBER 5 SAMPLES

AIR-O-CELL CASSETTES:

Outside the air results were found to be high at 1,973 Counts per Cubic Meter of Air for total spores – 64 % *Cladosporium*, 14 % each of *Aspergillus / Penicillium* and *Basidiospores,* 3 % *Amerospores,* and six (6) other species at 1 %.

Air samples collected from inside were lower than the outside air. The sample taken from the Mechanical Room was reported to contain 347 Counts per Cubic Meter for the Air-O-Cell Cassette. The analysis reported 23 % *Basidiospores*, 19 % each of *Amerospores* and *Cladosporium*, 15 % Ascospores, 8 % *Oidium / Peronospora*, and four (4) other species at 4 % each.

The second highest sample for Air-O-Cell was reported from the Events Support area at 93 Counts per Cubic Meter – 71 % *Amerospores* and 29 % *Ascospores*.

Tied for third highest at 80 Counts from the Electric Vault and Tech Support. The Electric Vault sample reported 67 % *Cladosporium,* and 17 % each of *Amerospores* and *Aureobasidium*. The Tech Support sample revealed 33 % each of *Alternaria, Basidiospores*, and *Cladosporium*.

An Air-O-Cell cassette taken from the area by Room 402 had 40 Counts – all Cladosporium. The lowest level found was found by Room 417 at 13 Counts – all Amerospores.

PETRI DISH SAMPLES:
From the viable (Petri dish) cultures, 625 Colony Forming Units per Cubic Meter of Air (CFU / M^3) of viable spores were incubated and identified in the outside air. 66 % of this sample was *Cladosporium*, 17 % *Penicillium*, 11 % *Alternaria*, and 6 % *Geotrichum*.

Another sample was collected from the fourth floor by 417. This revealed the same count as the Air-O-Cell Cassette at 13 CFU / M^3. The species were identified as 50 % *Cladosporium* and 50 % *Penicillium*.

VOLATILE ORGANIC COMPOUND SAMPLES:
A sample for VOCs was also collected by Room 417. Only two (2) organic compounds were identified of the 63 tested for; those were 2-propanol and acetone. The reported level for 2-propanol appeared to be elevated at 24,943 micrograms or 1,000 parts per billion. This is equivalent to one (1) part per million – well under the allowable exposures. Acetone was present at 190 parts per billion, also a very in low concentration.

A second sample was collected in the Events Support area. The same two organic compounds were identified — also in very low concentrations.

BULK SAMPLES:
Two (2) bulk samples were collected using swabs. One sample was collected from the HVAC register in the Center of Room 403. This sample did not reveal the presence of any fungal spores; therefore the staining must be dirt.

The swab taken from the Southwest Storage closet was reported to contain 5 – 25 % each of *Alternaria* and *Pithomyces / Ulocladium* and *Stachybotrys.*

SEPTEMBER 27 SAMPLES

A total of seven (7) samples were collected – five (5) air samples and two (2) swab samples. The areas of concern were closets adjacent to and the Multi-Purpose Room; these rooms were locked, but not sealed in plastic, as requested. *Stachybotrys* was found both in the air and on bulk samples collected.

Outside, the airborne level was elevated at 1,813 Counts per Cubic Meter of Air. This sample consisted of 47 % *Cladosporium*, 29 % *Amerospores*, 12 % *Arthrinium*, and 10 % *Basidiospores*. As before, this is the baseline, or standard for comparison to other interior samples.

On the first floor, two (2) air samples inside the storage closets tied for the highest levels at 80 Counts. The Southwest Corner Closet (adjacent to Joe Anderson's desk) had 80 Counts – 60 % of which was *Amerospores*, 33 % *Ascospores*, and 17 % Smuts / *Myxomycetes*. The Northwest Corner (where light fixtures were stacked floor to ceiling), the level was also 80 Counts – 50 % of which was *Stachybotrys*, 33 % *Amerospores*, and 17 % Smuts / *Myxomycetes*. This would indicate visible mold is probably present, but was hidden from view by the items in storage.

The Center Storage Closet air sample only found 13 Counts - all *Amerospores*. In the Multi-Purpose Room, towards the Center of the Room, the air sample revealed 53 Counts, consisting of 75 % *Amerospores* and 25 % Smuts / *Myxomycetes*.

BULK SAMPLES: Two (2) bulk samples of visible mold were collected using swabs inside the Southwest Storage Closet. The samples were collected on the South Wall and the North Wall near the Baseboard. The North Wall sample revealed 25 – 75 % *Alternaria*, 25 – 75 % *Stachybotrys*, and 1 – 5 % each of *Amerospores* and *Cladosporium*. The sample collected from the visible mold on the South wall revealed 25 – 75 % *Alternaria,* 1 – 5 % *Amerospores,* and 5 – 25 % *Stachybotrys.*

CONCLUSIONS

The water on the First Floor caused damage and mold growth; it appears the source of moisture was from a roof leak or occurred during ice blasting of lead-based paint. It is anticipated that in addition to mold, particles of lead-based paint will be found behind these first floor walls on the West. *Stachybotrys* has been present for at least a year, although apparently without moisture. The source or sources of water appear to have been stopped or eliminated; this should be verified. Remediation for mold is mandated, primarily on the West side of the First floor. The remainder of the building did not appear to have a significant issue with mold, but may have issues with bird droppings, lead-based paint, and unsealed ventilation "shafts" (or the opening all along the West side) in the Mechanical Room, allowing access to the building of other materials.

RECOMMENDATIONS

Based on the evidence of mold growth, moisture, and damage, remediation is necessary. The following are guidelines to be followed by personnel trained in mold remediation, and not General Contractors. All remediation should be done by an organization familiar with mold abatement and conducted wearing the proper protective equipment. During the remediation, containment using 6-mil plastic sheeting and negative pressure using ventilation drawn through a HEPA filter prior to discharging should be utilized.

All contaminated sheetrock and wood must be removed using wet methods - misted with chlorine and water in order to minimize dust and spore generation; they should be placed in plastic bags and sealed inside the containment area.

Porous materials, such as joists, studs and plates, should be thoroughly examined for visible signs of fungal growth. If visual inspection reveals evidence of mold, the wooden structures and / or additional sheetrock may require removal. Deteriorated wood should be removed and replaced as part of the abatement effort. Once the contaminated materials are removed, visible signs of mold should be treated. ***Treatment*** consists of abrasive techniques (i.e., sanding, wire brushing, etc.) followed by HEPA vacuuming and application of a biocide, such as bleach and water, quaternary ammonium compounds, or other common biocides available for this purpose; gases such as chlorine or ozone should not be used.

DECONTAMINATION OF THE BUILDING:

West Side of the First Floor: Containment should be put in place along the three Closet areas. In addition, an air lock should be installed for entry and exit, and decontamination. Negative pressure, exhausted through HEPA air filters must be employed. Prior to work commencing on the North closet, all metal frames must be removed from storage; prior to removal from the containment, each one (probably over 75 frames) must be decontaminated inside the containment including HEPA vacuuming and wiping down with biocides.

All sheetrock, insulation and molding in all three (3) closets along the West wall should be removed and discarded from the floor to at least six (6) feet, after bagging inside the containment. As the sheetrock is removed, additional mold may be discovered; if so, the sheetrock and insulation should be removed at least four (4) feet beyond the discovered mold. Deteriorated wood, if found, should be removed and replaced, or treated, depending on severity of damage, as part of the abatement effort. Abrasive techniques should be used with HEPA vacuuming for the affected wood structures and metal studs, if used, exposed piping, and inside the wall cavities. Exposed structural wood with visible mold growth or discoloration should be treated as described above. Discolored ceiling tile should be removed and replaced throughout the building.

Flooring: Tile flooring (tile) should be removed in all closets and the exposed floor treated using HEPA vacuuming followed by biocide application.

HVAC System: The entire system should be cleaned and disinfected following abatement according to guidelines published such as those issued by the North American Duct Cleaning Association (NADCA). Flexible ducts, if used, should be replaced. During this process, all vents throughout the building should be thoroughly cleaned or replaced.

HEPA air filters ("air scrubbers") should be run 3 to 5 days following abatement.

OTHER: The exterior roof should be made waterproof. It is beyond the scope of this report to address lead-based paint issues; however, they appear to be significant. Birds and other animals should be removed from the building and all access areas sealed. The top of the Office building will probably require decontamination from lead-based paint chips and bird droppings.

Fungi are found almost everywhere indoors as well as out. In order for mold to survive it needs a source of food and a source of moisture. Typically, moisture comes from water leaks or from the air. All sources of excessive water infiltration, such as plumbing leaks and roof leaks, must be identified and stopped prior to any successful abatement activity.

The goal of remediation is to remove or clean contaminated materials in a way that prevents the emission of fungi and dust contaminated with fungi from leaving a work area and entering an occupied or non-abatement area, while protecting the health of workers performing the abatement, as well as the occupants.

It is the responsibility of the Contractors conducting remediation to ensure the methods enacted are adequate. The listed remediation methods are not meant to exclude other similarly effective methods. Any changes to the remediation methods listed in these guidelines, however, should be carefully considered prior to implementation.

The use of gaseous ozone or chlorine dioxide for remedial purposes is **not** recommended. Both compounds are highly toxic and contamination of occupied space may pose a health threat. Furthermore, the effectiveness of these treatments is unproven.

The following procedures are recommended for remediation / abatement:

- Containment of the affected area:
    1. Complete isolation of work area from non-affected spaces using plastic sheeting sealed with duct tape (including ventilation ducts / grills, fixtures, and any other openings)
    2. The use of an exhaust fan with a HEPA filter to generate negative pressure
    3. Airlocks and a decontamination area
- Personnel trained in the handling of hazardous materials equipped with the following types of Personal Protective Equipment (PPE):
    1. Respiratory protection (e.g., at a minimum, a N-95 disposable respirator), in accordance with the OSHA respiratory protection standard (29 CFR 1910.134), is recommended; alternatively full-face respirators with High Efficiency Particulate Air (HEPA) or P-100 filters may be used
    2. Disposable protective clothing covering both head and shoes
    3. Gloves
- Contaminated materials <u>that cannot be cleaned</u> should be removed from the building in sealed plastic bags. The outside of the bags should be cleaned with a damp cloth and a detergent / biocide solution or HEPA vacuumed in the decontamination chamber prior to their transport to uncontaminated areas of the building. There are currently no special requirements for the disposal of moldy materials.

- The contained area and decontamination room should be HEPA vacuumed and cleaned with a damp cloth and / or mop with a detergent / biocide solution and be visibly clean prior to the removal of isolation barriers.

These procedures are designed to minimize both exposure to the remediation crews and to minimize further exposure to the building and contents.

After remediation, additional visual inspection and clearance sampling conducted by or under the direction of a Certified Industrial Hygienist – not the abatement contractor – should be performed to verify the results of the abatement prior to reconstruction and occupancy. Air scrubbers must be turned off 24 to 48 hours before clearance testing.

Appendix A

Sampling Locations

Sample Locations -
September 5, 2001

Sample Number	Sample Type	Location
1	Air-O-Cell	By 417
2	Petri Dish	By 417
3	VOC	By 417
4	Swab	HVAC Register, Room 403
5	Air-O-Cell	By 402
6	Air-O-Cell	Events Support
7	VOC	Events Support
8	Air-O-Cell	Electric Vault
9	Swab	Southwest Storage Closet
10	Air-O-Cell	Mechanical Room
11	Air-O-Cell	Tech Support
12	Air-O-Cell	Outside
13	Petri Dish	Outside

Sample Locations-
September 27, 2001

Sample Number	Sample Type	Location
1	Air-O-Cell	1st Floor, Southeast Closet
2	Air-O-Cell	1st Floor, Center Closet
3	Air-O-Cell	1st Floor, Southwest Closet
4	Air-O-Cell	Multipurpose Room, Center
5	Air-O-Cell	Outside
6	Swab	Southeast Closet, South Wall
7	Swab	Southeast Closet, North Wall

Appendix B

Microbiological Results

And

Lab Data

AESI
1112 Charleston Ct.
Keller, TX 76248
Attn: David Anderson

AIHA Empat No. 102297

Air-O-Cell Cassette Analysis

Aerotech Method: A001

Lab Number: A-109-0689
Project Name: NYW
Project Number: 0981A (22)
Date Received: 09/07/01
Date Reported: 09/24/01

Lab Number	1				5				6			
Sample Identification	AOC 0835 417				AOC 0807 402				AOC 0819 Events Support			
Volume (M^3)	0.0750				0.0750				0.0750			
Date Analyzed	09/10/2001				09/10/2001				09/10/2001			
Percent Of Trace Analyzed	100% of Trace at 600X Magnification				100% of Trace at 600X Magnification				100% of Trace at 600X Magnification			
Debris Rating	2				2				2			
		Count/M^3				Count/M^3				Count/M^3		
	Total Count	Result	Detection Limit	%	Total Count	Result	Detection Limit	%	Total Count	Result	Detection Limit	%
Mycelial Fragments	<1	<13	13	n/a	<1	<13	13	n/a	<1	<13	13	n/a
Pollen Count	<1	<13	13	n/a	<1	<13	13	n/a	<1	<13	13	n/a
Total Fungal Spores	1	13	13	100	3	40	13	100	7	93	13	100
	Fungal Spore Identification				Fungal Spore Identification				Fungal Spore Identification			
Alternaria												
Amerospores	1	13	13	100					5	67	13	71
Arthrinium												
Ascospores									2	27	13	29
Aspergillus/Penicillium												
Aureobasidium												
Basidiospores												
Bipolaris/Dreschlera												
Botrytis												
Chaetomium												
Cladosporium					3	40	13	100				
Curvularia												
Epicoccum												
Fusarium												
Nigrospora												
Oidium/Peronospora												
Pithomyces/Ulocladium												
Rusts												
Smuts/Myxomycetes												
Stachybotrys												
Stemphylium												
Torula												
Unidentified Conidia												
Notes:												

Prepared By:
CS Review:

Technical Review:
Final Review:

AESI
1112 Charleston Ct.
Keller, TX 76248
Attn: David Anderson

AIHA Empat No. 102297

Air-O-Cell Cassette Analysis

Aerotech Method: A001

Lab Number: A-109-0689
Project Name: NYW
Project Number: 0981-A (22)
Date Received: 09/07/01
Date Reported: 09/24/01

Lab Number	8				10				11			
Sample Identification	AOC 0821 Elec. Valt				AOC 0830 Mech Rm.				AOC 0809 Tech Support			
Volume (M^3)	0.0750				0.0750				0.0750			
Date Analyzed	09/10/2001				09/10/2001				09/10/2001			
Percent Of Trace Analyzed	100% of Trace at 600X Magnification				100% of Trace at 600X Magnification				100% of Trace at 600X Magnification			
Debris Rating	2				3				3			
		Count/M^3				Count/M^3				Count/M^3		
	Total Count	Result	Detection Limit	%	Total Count	Result	Detection Limit	%	Total Count	Result	Detection Limit	%
Mycelial Fragments	<1	<13	13	n/a	<1	<13	13	n/a	<1	<13	13	n/a
Pollen Count	<1	<13	13	n/a	1	13	13	n/a	<1	<13	13	n/a
Total Fungal Spores	6	80	13	100	26	347	13	100	6	80	13	100
	Fungal Spore Identification				Fungal Spore Identification				Fungal Spore Identification			
Alternaria					1	13	13	4	2	27	13	33
Amerospores					5	67	13	19				
Arthrinium	1	13	13	17								
Ascospores					4	53	13	15				
Aspergillus/Penicillium												
Aureobasidium												
Basidiospores	1	13	13	17	6	80	13	23	2	27	13	33
Bipolaris/Dreschlera					1	13	13	4				
Botrytis												
Chaetomium												
Cladosporium	4	53	13	67	5	67	13	19	2	27	13	33
Curvularia												
Epicoccum												
Fusarium												
Nigrospora					2	27	13	8				
Oidium/Peronospora												
Pithomyces/Ulocladium												
Rusts					1	13	13	4				
Smuts/Myxomycetes					1	13	13	4				
Stachybotrys												
Stemphylium												
Torula												
Unidentified Conidia												
Notes:												

Prepared By:
CS Review:

Technical Review:
Final Review:

AESI
1112 Charleston Ct.
Keller, TX 76248
Attn: David Anderson

AIHA Empat No. 102297

Air-O-Cell Cassette Analysis

Aerotech Method: A001

Lab Number: A-109-0689
Project Name: NYW
Project Number: 0981-A (22)
Date Received: 09/07/01
Date Reported: 09/24/01

Lab Number	12			
Sample Identification	AOC 0804 Out			
Volume (M^3)	0.0750			
Date Analyzed	09/10/2001			
Percent Of Trace Analyzed	100% of Trace at 600X Magnification			
Debris Rating	2			
		Count/M^3		
	Total Count	Result	Detection Limit	%
Mycelial Fragments	2	27	13	n/a
Pollen Count	10	133	13	n/a
Total Fungal Spores	148	1,973	13	100
	Fungal Spore Identification			
Alternaria	2	27	13	1
Amerospores	4	53	13	3
Arthrinium				
Ascospores	20	267	13	14
Aspergillus/Penicillium				
Aureobasidium				
Basidiospores	20	267	13	14
Bipolaris/Dreschlera				
Botrytis				
Chaetomium				
Cladosporium	95	1,267	13	64
Curvularia	1	13	13	1
Epicoccum				
Fusarium				
Nigrospora				
Oidium/Peronospora	1	13	13	1
Pithomyces/Ulocladium	2	27	13	1
Rusts				
Smuts/Myxomycetes	2	27	13	1
Stachybotrys				
Stemphylium				
Torula	1	13	13	1
Unidentified Conidia				
Notes:				

Prepared By:
CS Review:

Technical Review:
Final Review:

AESI
1112 Charleston Ct.
Keller, TX 76248
Attn: David Anderson

Lab Number: A-109-0689
Project Name: NYW
Project Number: 0981-A (22)
Date Received: 09/07/01
Date Reported: 09/24/01

AIHA Empat No. 102297

Viable Fungi Analysis - Air

Aerotech Method: A003

Lab Number	2				13			
Sample Identification	Petri 417				Petri Out			
Date Incubated	09/07/2001				09/07/2001			
Date Analyzed	09/20/2001				09/20/2001			
Culture Media	Potato Dextrose (PDA)				Potato Dextrose (PDA)			
Volume (M^3)	0.1500				0.0560			
		CFU/M^3				CFU/M^3		
	CFU	Result	Detection Limit	%	CFU	Result	Detection Limit	%
Viable Fungi 20-25°C	2	13	7	100	35	625	18	100
Acremonium								
Alternaria					4	71	18	11
Aspergillus fumigatus								
Aspergillus niger								
Aspergillus species Var. 1								
Aspergillus species Var. 2								
Aureobasidium								
Bipolaris								
Chaetomium								
Chrysosporium								
Cladosporium	1	7	7	50	23	411	18	66
Cunninghamella								
Curvularia								
Epicoccum								
Fusarium					2	36	18	6
Geotrichum								
Mucor								
Mycelia sterilia								
Paecilomyces								
Penicillium species Var. 1	1	7	7	50	6	107	18	17
Penicillium species Var. 2								
Phoma								
Rhizopus								
Sporotrichum								
Stachybotrys								
Stemphylium								
Trichoderma								
Ulocladium								
Yeast								
Notes:								

Prepared By:
CS Review:

Technical Review:
Final Review:

AESI
1112 Charleston Ct.
Keller, TX 76248
Attn: David Anderson

Lab Number: A-109-0689
Project Name: NYW
Project Number: 0981-A (22)
Date Received: 09/07/01
Date Reported: 09/24/01

AIHA Empat No. 102297

Microscopic Screen and Fungi Identification

Aerotech Method: S001

Lab Number	**4**	**9**
Sample Identification	Swab HVAC Cent #403	Swab SW Storage Closet
Date Analyzed	09/10/2001	09/10/2001
	Results	**Results**
Mycelial Fragments	None Detected	1-5%
Fungal Spores	None Detected	25-75%
	Fungal Spore Identification	**Fungal Spore Identification**
Alternaria		5-25%
Amerospores		
Arthrinium		
Ascospores		
Aspergillus/Penicillium		
Aureobasidium		
Basidiospores		
Bipolaris/Dreschlera		
Botrytis		
Chaetomium		
Cladosporium		
Curvularia		
Epicoccum		
Fusarium		
Nigrospora		
Oidium/Peronospora		
Pithomyces/Ulocladium		5-25%
Rusts		
Smuts/Myxomycetes		
Stachybotrys		**5-25%**
Stemphylium		
Torula		
Unidentified Conidia		
Notes:		

Prepared By:
CS Review:

Technical Review:
Final Review:

AESI
1112 Charleston Ct.
Keller, TX 76248
Attn: David Anderson

Lab Number: A-109-0689-03
Project ID: NYW/0981-A (22)
Sample ID: VOC
Sample Size: 400 mL Can
Date Received: 09/07/01
Date Analyzed: 09/07/00
Date Reported: 10/13/01

Volatile Organic Compounds (VOC's) - Air

EPA TO14A/TO15

Results			
Compound	**ppbv**	**µg/m³**	**Comments**
1,1,1-Trichloroethane	<2.0	<11.1	
1,1,2,2-Tetrachloroethane	<2.0	<14	
1,1,2-Trichloroethane	<2.0	<11.1	
1,1-Dichloroethane	<2.0	<8.2	
1,1-Dichloroethene	<2.0	<8.1	
1,2,4-Trichlorobenzene	<2.0	<15	
1,2,4-Trimethylbenzene	<2.0	<10	
1,2-Dibromoethane	<2.0	<15.6	
1,2-Dichlorobenzene	<2.0	<12.2	
1,2-Dichloroethane	<2.0	<8.2	
1,2-Dichloropropane	<2.0	<9.4	
1,3,5-Trimethylbenzene	<2.0	<10	
1,3-Butadiene	<2.0	<4.5	
1,3-Dichlorobenzene	<2.0	<12.2	
1,4-Dichlorobenzene	<2.0	<12.2	
2,2,4-Trimethylpentane	<2.0	<9.5	
2-Butanone (MEK)	<2.0	<6	
2-Hexanone	<2.0	<8.3	
2-Propanol	1000	2494.3	
4-Ethyltoluene	<2.0	<8.8	
4-Methyl-2-pentanone	<4.0	<16.6	
Acetone	190	458.1	
Allyl chloride	<2.0	<6.4	
Benzene	<2.0	<6.5	
Benzyl chloride	<2.0	<10.6	
Bromodichloromethane	<2.0	<13.6	
Bromoethene(Vinyl Bromide)	<2.0	<8.9	
Bromoform	<2.0	<21	
Bromomethane	<2.0	<7.9	
Carbon disulfide	<2.0	<6.3	
Carbon tetrachloride	<2.0	<12.8	
Chlorobenzene	<2.0	<9.4	
Chloroethane	<2.0	<5.4	
Chloroform	<2.0	<9.9	
Chloromethane	<2.0	<4.2	
cis-1,2-Dichloroethene	<2.0	<8	
cis-1,3-Dichloropropene	<2.0	<9.2	
Cyclohexane	<2.0	<7	

Input By:
CS Review:

Technical Review:
Final Review:

AESI
1112 Charleston Ct.
Keller, TX 76248
Attn: David Anderson

Lab Number: A-109-0689-03
Project ID: NYW/0981-A (22)
Sample ID: VOC
Sample Size: 400 mL Can
Date Received: 09/07/01
Date Analyzed: 09/07/00
Date Reported: 10/13/01

Volatile Organic Compounds (VOC's) - Air

EPA TO14A/TO15

Results			
Compound	**ppbv**	**µg/m³**	**Comments**
Dibromochloromethane	<2.0	<17.3	
Dichlorodifluoromethane(F-12)	<2.0	<10.1	
Dichlorotetrafluoroethane(F-11)	<2.0	<11.4	
Ethyl Acetate	<2.0	<7.3	
Ethylbenzene	<2.0	<8.8	
Heptane	<2.0	<8.3	
Hexachlorobutadiene	<2.0	<21.7	
Hexane	<2.0	<7.2	
m&p-Xylene	<4.0	<17.6	
Methyl tert-butyl ether	<4.0	<14.6	
Methylene chloride	<2.0	<7.1	
o-Xylene	<2.0	<8.8	
Propene (Propylene)	<2.0	<3.5	
Styrene	<2.0	<8.6	
Tetrachloroethene	<2.0	<13.8	
Tetrahydrofuran	<4.0	<12	
Toluene	<2.0	<7.7	
trans-1,2-Dichloroethene	<2.0	<8	
trans-1,3-Dichloropropene	<2.0	<9.2	
Trichloroethene	<2.0	<10.9	
Trichlorofluoromethane	<2.0	<11.4	
Trichlorotrifluoroethane	<2.0	<15.5	
Vinyl acetate	<2.0	<7.2	
Vinyl chloride	<2.0	<5.2	

Non-Target Analytes

Estimated Concentration (ppbv)	Number Of Compounds Detected
>200	0
10-50	0
50-200	0

Input By:
CS Review:

Technical Review:
Final Review:

AESI
1112 Charleston Ct.
Keller, TX 76248
Attn: David Anderson

Lab Number: A-109-0689-07
Project ID: NYW/0981-A (22)
Sample ID: VOC Events Support
Sample Size: 400 mL Can
Date Received: 09/07/01
Date Analyzed: 09/07/00
Date Reported: 10/13/01

Volatile Organic Compounds (VOC's) - Air

EPA TO14A/TO15

Results			
Compound	**ppbv**	**µg/m³**	**Comments**
1,1,1-Trichloroethane	<2.0	<11.1	
1,1,2,2-Tetrachloroethane	<2.0	<14	
1,1,2-Trichloroethane	<2.0	<11.1	
1,1-Dichloroethane	<2.0	<8.2	
1,1-Dichloroethene	<2.0	<8.1	
1,2,4-Trichlorobenzene	<2.0	<15	
1,2,4-Trimethylbenzene	<2.0	<10	
1,2-Dibromoethane	<2.0	<15.6	
1,2-Dichlorobenzene	<2.0	<12.2	
1,2-Dichloroethane	<2.0	<8.2	
1,2-Dichloropropane	<2.0	<9.4	
1,3,5-Trimethylbenzene	<2.0	<10	
1,3-Butadiene	<2.0	<4.5	
1,3-Dichlorobenzene	<2.0	<12.2	
1,4-Dichlorobenzene	<2.0	<12.2	
2,2,4-Trimethylpentane	<2.0	<9.5	
2-Butanone (MEK)	<2.0	<6	
2-Hexanone	<2.0	<8.3	
2-Propanol	24	59.9	
4-Ethyltoluene	<2.0	<8.8	
4-Methyl-2-pentanone	<4.0	<16.6	
Acetone	200	482.2	
Allyl chloride	<2.0	<6.4	
Benzene	<2.0	<6.5	
Benzyl chloride	<2.0	<10.6	
Bromodichloromethane	<2.0	<13.6	
Bromoethene(Vinyl Bromide)	<2.0	<8.9	
Bromoform	<2.0	<21	
Bromomethane	<2.0	<7.9	
Carbon disulfide	<2.0	<6.3	
Carbon tetrachloride	<2.0	<12.8	
Chlorobenzene	<2.0	<9.4	
Chloroethane	<2.0	<5.4	
Chloroform	<2.0	<9.9	
Chloromethane	<2.0	<4.2	
cis-1,2-Dichloroethene	<2.0	<8	
cis-1,3-Dichloropropene	<2.0	<9.2	
Cyclohexane	<2.0	<7	

Input By:
CS Review:

Technical Review:
Final Review:

AESI
1112 Charleston Ct.
Keller, TX 76248
Attn: David Anderson

Lab Number: A-109-0689-07
Project ID: NYW/0981-A (22)
Sample ID: VOC Events Support
Sample Size: 400 mL Can
Date Received: 09/07/01
Date Analyzed: 09/07/00
Date Reported: 10/13/01

Volatile Organic Compounds (VOC's) - Air

EPA TO14A/TO15

Results			
Compound	**ppbv**	**$\mu g/m^3$**	**Comments**
Dibromochloromethane	<2.0	<17.3	
Dichlorodifluoromethane(F-12)	<2.0	<10.1	
Dichlorotetrafluoroethane(F-11)	<2.0	<11.4	
Ethyl Acetate	<2.0	<7.3	
Ethylbenzene	<2.0	<8.8	
Heptane	<2.0	<8.3	
Hexachlorobutadiene	<2.0	<21.7	
Hexane	<2.0	<7.2	
m&p-Xylene	<4.0	<17.6	
Methyl tert-butyl ether	<4.0	<14.6	
Methylene chloride	<2.0	<7.1	
o-Xylene	<2.0	<8.8	
Propene (Propylene)	<2.0	<3.5	
Styrene	<2.0	<8.6	
Tetrachloroethene	<2.0	<13.8	
Tetrahydrofuran	<4.0	<12	
Toluene	<2.0	<7.7	
trans-1,2-Dichloroethene	<2.0	<8	
trans-1,3-Dichloropropene	<2.0	<9.2	
Trichloroethene	<2.0	<10.9	
Trichlorofluoromethane	<2.0	<11.4	
Trichlorotrifluoroethane	<2.0	<15.5	
Vinyl acetate	<2.0	<7.2	
Vinyl chloride	<2.0	<5.2	

Non-Target Analytes

Estimated Concentration (ppbv)	Number Of Compounds Detected
>200	0
10-50	1
50-200	0

Input By:
CS Review:

Technical Review:
Final Review:

AESI
1112 Charleston Ct.
Keller, TX 76248
Attn: Dr. David Anderson

AIHA Empat No. 102297

Air-O-Cell Cassette Analysis

Aerotech Method: A001

Lab Number: A-109-4276
Project Name: WNY 22
Project Number: 0981 (B)
Date Received: 09/29/01
Date Reported: 10/01/01

Lab Number	**1**				**2**				**3**			
Sample Identification	0823 1st Floor SE/C				0861 1st Floor Center				0857 1st Floor SW/C			
Volume (M^3)	0.0750				0.0750				0.0750			
Date Analyzed	09/30/2001				09/30/2001				09/30/2001			
Percent Of Trace Analyzed	100% of Trace at 600X Magnification				100% of Trace at 600X Magnification				100% of Trace at 600X Magnification			
Debris Rating	3				3				3			
		Count/M^3				**Count/M^3**				**Count/M^3**		
	Total Count	**Result**	**Detection Limit**	**%**	**Total Count**	**Result**	**Detection Limit**	**%**	**Total Count**	**Result**	**Detection Limit**	**%**
Mycelial Fragments	<1	<13	13	n/a	<1	<13	13	n/a	<1	<13	13	n/a
Pollen Count	<1	<13	13	n/a	<1	<13	13	n/a	<1	<13	13	n/a
Total Fungal Spores	6	80	13	100	1	13	13	100	6	80	13	100
	Fungal Spore Identification				**Fungal Spore Identification**				**Fungal Spore Identification**			
Alternaria												
Amerospores	3	40	13	50	1	13	13	100	2	27	13	33
Arthrinium												
Ascospores	2	27	13	33								
Aspergillus/Penicillium												
Aureobasidium												
Basidiospores												
Bipolaris/Dreschlera												
Botrytis												
Chaetomium												
Cladosporium												
Curvularia												
Epicoccum												
Fusarium												
Nigrospora												
Oidium/Peronospora												
Pithomyces/Ulocladium												
Rusts												
Smuts/Myxomycetes	1	13	13	17					1	13	13	17
Stachybotrys									3	40	13	50
Stemphylium												
Torula												
Unidentified Conidia												
Notes:												

Prepared By:
CS Review:

Technical Review:
Final Review:

AESI
1112 Charleston Ct.
Keller, TX 76248
Attn: Dr. David Anderson

AIHA Empat No. 102297

Air-O-Cell Cassette Analysis

Aerotech Method: A001

Lab Number: A-109-4276
Project Name: WNY 22
Project Number: 0981 (B)
Date Received: 09/29/01
Date Reported: 10/01/01

Lab Number	**4**				**5**			
Sample Identification	0812 1st Floor Multi Purpose				0894 Outside			
Volume (M^3)	0.0750				0.0750			
Date Analyzed	09/30/2001				09/30/2001			
Percent Of Trace Analyzed	100% of Trace at 600X Magnification				100% of Trace at 600X Magnification			
Debris Rating	3				3			
		Count/M^3				**Count/M^3**		
	Total Count	**Result**	**Detection Limit**	**%**	**Total Count**	**Result**	**Detection Limit**	**%**
Mycelial Fragments	1	13	13	n/a	8	107	13	n/a
Pollen Count	<1	<13	13	n/a	<1	<13	13	n/a
Total Fungal Spores	4	53	13	100	136	1,813	13	100
	Fungal Spore Identification				**Fungal Spore Identification**			
Alternaria								
Amerospores	3	40	13	75	40	533	13	29
Arthrinium								
Ascospores					17	227	13	12
Aspergillus/Penicillium								
Aureobasidium								
Basidiospores					13	173	13	10
Bipolaris/Dreschlera								
Botrytis								
Chaetomium								
Cladosporium					64	853	13	47
Curvularia								
Epicoccum								
Fusarium								
Nigrospora								
Oidium/Peronospora								
Pithomyces/Ulocladium								
Rusts								
Smuts/Myxomycetes	1	13	13	25	2	27	13	1
Stachybotrys								
Stemphylium								
Torula								
Unidentified Conidia								
Notes:								

Prepared By:
CS Review:

Technical Review:
Final Review:

AESI
1112 Charleston Ct.
Keller, TX 76248
Attn: Dr. David Anderson

Lab Number: A-109-4276
Project Name: WNY 22
Project Number: 0981 B
Date Received: 09/29/01
Date Reported: 10/01/01

AIHA Empat No. 102297

Microscopic Screen and Fungi Identification

Aerotech Method: S001

Lab Number	**6**	**7**
Sample Identification	SE/C S Wall	SE/C N Wall
Date Analyzed	09/30/2001	09/30/2001
	Results	**Results**
Mycelial Fragments	5-25%	25-75%
Fungal Spores	25-75%	75-100%
	Fungal Spore Identification	**Fungal Spore Identification**
Alternaria	25-75%	25-75%
Amerospores	1-5%	1-5%
Arthrinium		
Ascospores		
Aspergillus/Penicillium		
Aureobasidium		
Basidiospores		
Bipolaris/Dreschlera		
Botrytis		
Chaetomium		
Cladosporium		1-5%
Curvularia		
Epicoccum		
Fusarium		
Nigrospora		
Oidium/Peronospora		
Pithomyces/Ulocladium		
Rusts		
Smuts/Myxomycetes		
Stachybotrys	5-25%	25-75%
Stemphylium		
Torula		
Unidentified Conidia		
Notes:		

Prepared By:
CS Review:

Technical Review:
Final Review:

AEROTECH LABORATORIES, INC.

Monday, October 01, 2001

Dr. David Anderson
AESI
1112 Charleston Ct.
Keller, TX 76248

Re: Aerotech Project Number A-109-4276

Dear Dr. David:

Aerotech is pleased to provide the enclosed report of analyses for samples submitted Saturday, September 29, 2001. This cover letter and accompanying pages are an integral part of this report. All analyses are performed in our AIHA proficiency-tested laboratory under the FDA Good Laboratory Practice Guidelines and the parameters outlined in the most current version of the American Conference of Governmental Industrial Hygienists Bioaerosol Guidelines. The data generated in this report is based on the samples and accompanying information provided. Aerotech employees did not collect samples for this project, and may provide limited interpretation of this data as it relates to the overall investigation.

Quality Assurance

Aerotech is staffed by certified microbiologists, maintains a rigorous Quality Assurance program and participates in the American Industrial Hygiene Association's Environmental Microbiology Proficiency Testing Program. Our AIHA EMPAT Number is 102297. Aerotech is extremely proud of its excellent scoring in this program and will provide copies of our results upon request. They can also be downloaded from our web site at www.aerotechlabs.com. Below you will find additional information regarding the specific analyses requested for this project.

A001, A002, WC001

Air-O-Cell Cassette

The Air-O-Cell Cassette is a unique sampling device designed for the rapid collection and analysis of a wide range of airborne particles, including fungal spores. Samples are analyzed via light microscopy at 600X magnification, with the entire slide (100% of the sample) being analyzed. The results are reported as **total**, meaning they include both viable and non-viable fungal spores. Unfortunately, this technique does not allow for the differentiation between *Aspergillus* and *Penicillium* spores. Small (~1-3μ) spherical fungal spores that cannot be identified and may include *Aspergillus*, *Penicillium*, and *Trichoderma* and others are grouped together as *Amerospores.* Additionally it does not allow for cultivation or speciation of spores. Slides containing greater than 500 fungal spores are difficult to count accurately due to overcrowding and are therefore estimations. Similarly, excessive non-microbial particulates can mask the presence of fungal spores, thereby reducing counting accuracies. All slides are graded with the following debris scale for data qualification.

Debris Rating Scale

Non-Microbial Particulate Debris Rating	Description	Interpretation
0	No particles detected	No particulates in on slide. The absence of particulates could indicate improper sampling, as most air samples typically contain some particulates
1	Minimal non-microbial debris present.	Reported values are not affected by debris.
2	Up to 25% of the slide occluded with non-microbial particulates.	Non-microbial particulates can mask the presence of fungal spores. As a result, actual values could be up to 1.3 times higher than reported.
3	26% to 75% of the slide occluded with non-microbial particulates.	Non-microbial particulates can mask the presence of fungal spores. As a result, actual values could be up to 1.4 to 4 times higher than reported
4	76% to 90% of the slide occluded with non-microbial particulates.	Non-microbial particulates can mask the presence of fungal spores. As a result, actual values could be up to 4 to 10 times higher than reported.
5	Greater than 90% of the slide occluded with non-microbial particulates.	Quantification not possible. Resamples should be collected at shorter time interval, or other measures taken to reduce the collection of non-microbial debris.

B001, S001

Microscopic Screen

A microscopic screen is a rapid analytical technique for confirming the presence and identity of fungi on a surface. The results are expressed as a total count of the fungal spores per sample matrix unit. Samples are analyzed via light microscopy at 600X magnification. The results are reported as **total**, meaning they include both viable and non-viable fungal spores. Unfortunately, this technique does not allow for the differentiation between *Aspergillus* and *Penicillium* spores. Small (~1-3μ) spherical fungal spores that cannot be identified and may include *Aspergillus*, *Penicillium*, and *Trichoderma* are grouped together as *Amerospores*. Additionally this analysis does not allow for cultivation or speciation of spores.

For additional information, or if you have any questions regarding this report, please do not hesitate to call.

Sincerely,

Ruth Skinner
Project Manager
Aerotech Laboratories, Inc.
800-651-4802

Analytical References

1. Medically Important Fungi: A Guide to Identification, 3rd ed., ASM, 1995.
2. Standard Methods for the Examination of Water and Wastewater, 19th ed., APHA, 1995.

3. Sampling and Identifying Allergenic Pollens and Molds, Blewstone, 1990.
4. Identifying Filamentous Fungi: A Clinical Laboratory Handbook, Star, 1996.
5. Manual of Clinical Microbiology, 7th ed., ASM, 1999.
6. A Laboratory Guide to Common *Aspergillus* Species and their Teleomorphs, CSIRO, 1994.
7. Bioaerosols: Assessment and Control, ACGIH, 1999.

Appendix C

Fungal Glossary

FUNGAL GLOSSARY

Acremonium sp. (Cephalosporium sp.) - Reported to be allergenic. Can produce a trichothecene toxin that is toxic if ingested. It was the primary fungus identified in at least two houses where the occupant complaints were nausea, vomiting and diarrhea. The asexual state of *Emericellopsis sp., Chaetomium sp.*, and *Nectripsis sp.*, it can produce mycetomas, infections of the cornea and nails.

Alternaria sp. - Conidia dimensions 18-83 x 7-18 microns. A very common allergen with an IgE mediated response. It is often found in carpets, textiles, and on horizontal surfaces in building interiors. Often found on window frames. Outdoors it may be isolated from samples of soil, seeds and plants. It is commonly found in outdoor samples. The large spore size 20 - 200 microns in length and 7 - 18 microns in sizes, suggests that the spores from this fungi will deposited in the nose, mouth and upper respiratory tract. It may be related to "Baker's Asthma." It has been associated with hypersensitivity pneumonitis. The species *Alternaria alternata* is capable of producing tenuazonic acid and other toxic metabolites, which may be associated with disease in humans or animals. Common cause of extrinsic asthma (immediate-type hypersensitivity: type I). Acute symptoms include edema and bronchiospasms; chronic cases may develop pulmonary emphysema.

Aspergillus flavus - Conidia dimensions 3-6 microns. It grows on moldy corn and peanuts. It can be found in warm soil, foods and dairy products. Some strains are capable of producing a group of mycotoxins - in the aflatoxin group. Aflatoxins are known animal carcinogen. There is limited evidence to suggest that this toxin is a human carcinogen. The toxin is a poisonous to humans by ingestion. It may also result in occupational disease via inhalation. Experiments have indicated that it is teratogenic and mutagenic. It is toxic to the liver. It is reported to be allergenic. Its presence is associated with reports of asthma. It can be found in water-damaged carpets. The production of the fungal toxin is dependent on the growth conditions and on the substrate used as a food source. This fungus is associated with aspergillosis of the lungs and/or disseminated aspergillosis. This fungus is occasionally identified as the cause of corneal, otomycotic and nasoorbital infections.

Aspergillus fumigatus - Conidia dimensions 2-3.5 microns. Major cause of aspergillosis. This organism causes both invasive and allergic aspergillosis. Aspergillosis affects individuals who are immune compromised. It is considered a human pathogen. It grows well at 35 ^{0} C. It is commonly found outdoors in compost piles with temperatures higher than 40 ^{0} C, in mild to warm soils and on cereals.

Aspergillus nidulans - Conidia dimensions 2-4 microns. Found in mild to warm soils and on slowly decaying plants. Can produce the mycotoxin sterigmatocystin. This toxin has been shown to produce liver and kidney damage in lab animals. This fungus is associated with aspergillosis of the lungs and/or disseminated aspergillosis. This species is only occasionally pathogenic.

Aspergillus niger - Conidia dimensions 3.5 - 5 microns or 4 to 5 microns. Less common cause of aspergillosis. It has a musty odor. It is commonly found in the environment on textiles, in soils, grains, fruits and vegetables. It has been reported to cause skin and pulmonary infections. It is a common cause of fungal related ear infections-otomycosis.

Aspergillus sp. - Reported to be allergenic. Members of this genus are reported to cause ear infections. Many species produce mycotoxins, which may be associated with disease in humans and other animals. Toxin production is dependent on the species or a strain within a species and on the food source for the fungus. Some of these toxins have been found to be carcinogenic in animal species. Several toxins are considered potential human carcinogens. Common cause of extrinsic asthma (immediate-type hypersensitivity: type I). Acute symptoms include edema and bronchiospasms; chronic cases may develop pulmonary emphysema.

Aspergillus versicolor -Conidia dimensions 2-3.5 microns. It is commonly found in soil, hay, cotton and dairy products, it can produce a mycotoxin sterigmatocystin and cyclopiaxonic acid. These toxins can cause diarrhea and upset stomach. It is reported to be a kidney and liver carcinogen. This species is only occasionally pathogenic.

Basidiomycetes - Fungal spores that are from mushrooms. The specific mushroom species cannot be identified on the culture plate. Many mushroom spores are reported to be allergenic.

Bipolaris sp. - A fungus with large spores that would be expected to be deposited in the upper respiratory tract. This fungus can produce the mycotoxin - sterigmatocystin that has been shown to produce liver and kidney damage when ingested by laboratory animals.

Blastomyces sp. - Human pathogen. The fungus is commonly found in soil. It is a dimorphic fungus, which has filamentous fungus when grown at 25 $^{\circ}$ C, and a yeast form at 37 $^{\circ}$ C.

Botrytis sp. - Conidia dimensions 7-14 x 5-9 microns. Found in soil and vegetables. Possibly associated with allergic symptoms (skin tests)

Chaetomium sp. - Large ascomycetous fungus producing perithecia. It is found on a variety of substrates containing cellulose including paper and plant compost. It has been found on paper in sheetrock. It is reported to be allergenic. Can produce an *Acremonium*-like state on fungal media.

Cladosporium sp. (Hormodendrum sp.) - Most commonly identified outdoor fungus. The outdoor numbers are reduced in the winter. The numbers are often high in the summer. Often found indoors in numbers less than outdoor numbers. It is a common allergen. Indoor Cladosporium sp. may be different than the species identified outdoors. It is commonly found on the surface of fiberglass duct liner in the interior of supply ducts. A wide variety of plants are food sources for this fungus. It is found on dead plants, woody plants, food, straw, soil, paint and textiles. It can cause mycosis. Produces greater than 10 antigens. Antigens in commercial extracts are of variable quality and may degrade within weeks of preparation. Common cause of extrinsic asthma (immediate-type hypersensitivity: type I). Acute symptoms include edema and bronchiospasms; chronic cases may develop pulmonary emphysema.

Cunninghamella sp. - Can cause disseminated and pulmonary infections in immune compromised hosts.

Curvularia sp. - Reported to be allergenic. It may cause corneal infections, mycetoma and infections in immune compromised hosts.

Dreschlera sp. - Conidia dimensions 40-120 x 17-28 microns. Found on grasses, grains and decaying food. It can occasionally cause a corneal infection of the eye.

Epicoccum sp. - Conidia dimensions 15-25 microns. A common allergen, it is found in plants, soil, grains, textiles and paper products.

Fusarium sp. - A common soil fungus. It is found on a wide range of plants. It is often found in humidifiers. Several species in this genus can produce potent trichothecene toxins. The trichothecene (scirpene) toxin targets, the following systems: circulatory, alimentary, skin and nervous. Produces vomitoxin on grains during unusually damp growing conditions. Symptoms may occur either through ingestion of contaminated grains or possibly inhalation of spores. The genera can produce hemorrhagic syndrome in humans (alimentary toxic aleukia). Nausea, vomiting, diarrhea, dermatitis, and extensive internal bleeding characterize this. Reported to be allergenic. Frequently involved in eye, skin and nail infections.

Geotrichum sp. - Conidia dimensions 6-12 x 3-6 microns. A common contaminant of grains, fruits, dairy products, paper, textiles, soil and water, and often present as part of the normal human flora. The species *Geotrichum candidum* can cause a secondary infection (geotrichosis) in association with tuberculosis. This rare disease can cause lesions of the skin, bronchi, mouth, lung and intestine.

Gliocladium sp. - A fungus, which is structurally similar to *Penicillium sp*. It is reported to be allergenic.

Monilia sp. - Reported to be allergenic. This fungus produces soft rot of tree fruits. Other members produce a red bread mold. It is infrequently involved in corneal eye infections.

Mucor sp. - Often found in soil, dead plant material, horse dung, fruits and fruit juice. It is also found in leather, meat, dairy products, animal hair and jute. A *Zygomycetes* fungus that may be allergenic (skin and bronchial tests). This organism and other *Zygomycetes* will grow rapidly on most fungal media. May cause mucorosis in immune compromised individuals. The sites of infection are the lung, nasal sinus, brain, eye and skin. Infection may have multiple sites.

Paecilomyces sp. - Commonly found in soil and dust, less frequently in air. *P. variotii* can cause paecilomycosis. Linked to wood-trimmers disease and humidifier associated illnesses. They are reported to allergenic. Some members of this genus are reported to cause pneumonia. It may produce arsine gas if growing on arsenic substrate, which can occur on wallpapers covered with Paris green.

Penicillium sp. - A wide number of organisms have been placed in this genus. Identification to species is difficult. Often found in aerosol samples. Commonly found in soil, food, cellulose and grains. It is also found in paint and compost piles. It may cause hypersensitivity pneumonitis, allergic alveolitis in susceptible individuals. It is reported to be allergenic (skin). It is commonly found in carpet, wallpaper, and in interior fiberglass duct insulation. Some species can produce mycotoxins. Common cause of extrinsic asthma (immediate-type hypersensitivity: type I). Acute symptoms include edema and bronchiospasms; chronic cases may develop pulmonary emphysema.

Phoma sp. - A common indoor air allergen. It is similar to the early stages of growth of *Chaetomium sp*. The species are isolated from soil and associated plants (particularly potatoes). Produces pink and purple spots on painted walls. It may have antigens that cross-react with those of *Alternaria sp*. It will grow on butter, paint cement and rubber. It may cause phaeohyphomycosis a systematic or subcutaneous disease.

Rhizomucor sp. - The *Zygomycetous* fungus is reported to be allergenic. It may cause mucorosis in immune compromised individuals. It occupies a biological niche similar to *Mucor sp.* It is often linked to occupational allergy. May cause mucorosis in immune compromised individuals. The sites of infection are the lung, nasal sinus, brain, eye and skin. Infection may have multiple sites.

Rhizopus sp. - The *Zygomycetous* fungus is reported to be allergenic. It may cause mucorosis in immune compromised individuals. It occupies a biological niche similar to *Mucor sp*. It is often linked to occupational allergy. May cause mucorosis in immune compromised individuals. The sites of infection are the lung, nasal sinus, brain, eye and skin. Infection may have multiple sites.

Sporotrichum sp. - Reported to be allergenic. See also *Sporothrix* sp. there is some taxonomic confusion between these two genera. This genera does not cause sporotrichosis.

Stachybotrys sp. - Several strains of this fungus (*S. atra*, S. *chartarum* and S. *alternans* are synonymous) may produce a trichothecene mycotoxin- Satratoxin H - which is a poisonous by inhalation. The toxins are present on the fungal spores. This is a slow growing fungus on media. It does not compete well with other rapidly growing fungi. The dark colored fungi grows on building material with high cellulose content and low nitrogen content. Areas with relative humilities above 55% and are subject to temperature fluctuations are ideal for toxin production.

Individuals with chronic exposure to the toxin produced by this fungus reported cold and flu symptoms, sore throats, diarrhea, headaches, fatigue, dermatitis, intermittent local hair loss and generalized malaise. The toxins produced by this fungus will suppress the immune system affecting the lymphoid tissue and the bone marrow. Animals injected with the toxin from this fungus exhibited the following symptoms, necrosis and hemorrhage within the brain, thymus, spleen, intestine, lung, heart, lymph node, liver, and kidney. Affects by absorption of the toxin in the human lung are known as pneumomycosis.

This organism is rarely found in outdoor samples. It is usually difficult to find in indoor air samples unless it is physically disturbed or if there is (speculation- a drop in the relative humidity). The spores are in a gelatinous mass. Appropriate media for the growth of this organism will have high cellulose content and low nitrogen content. The spores will die readily after release. The dead spores are still allergenic and toxigenic. Percutaneous absorption has caused mild symptoms.

Stemphylium sp. - Reported to be allergenic. Isolated from dead plants and cellulose materials.

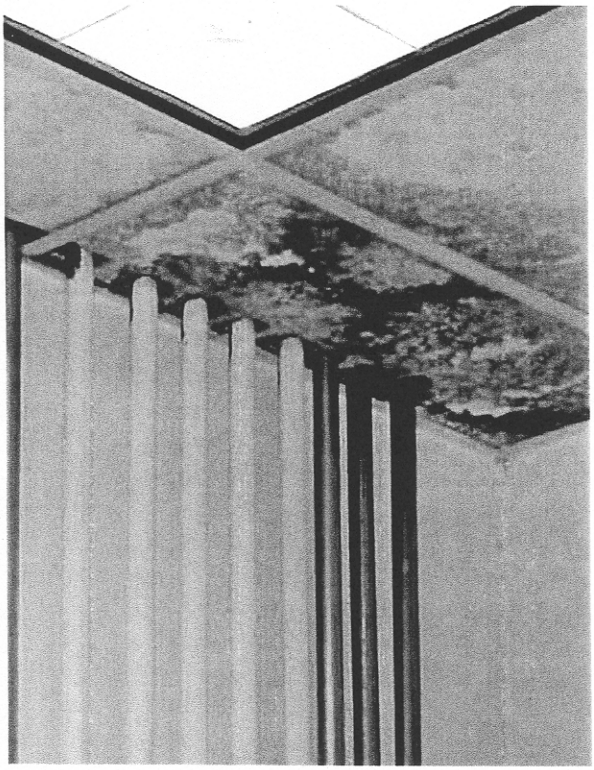
Trichoderma sp. - It is commonly found in soil, dead trees, pine needles, paper, and unglazed ceramics. It often will grow on other fungi. It produces antibiotics that are toxic to humans. It has been reported to be allergenic. It readily degrades cellulose.

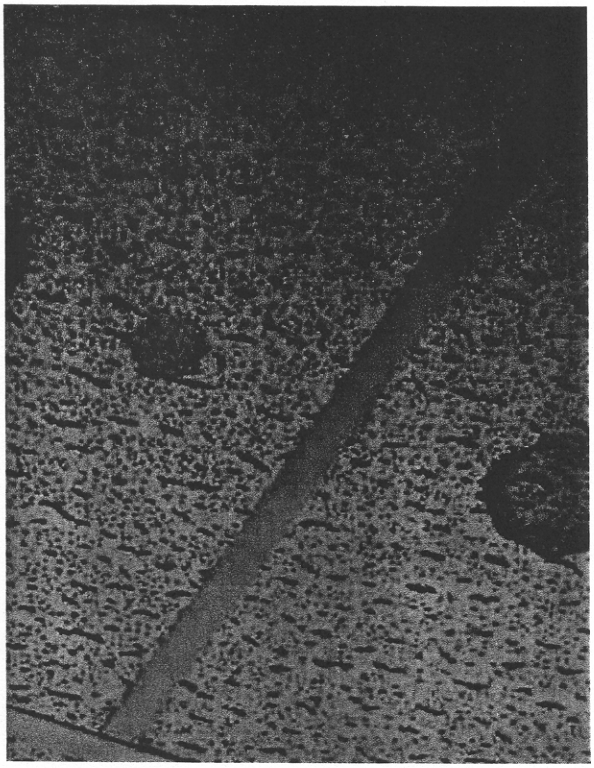
Trichothecium sp. - Conidia dimensions 12-23 x 8-10 microns. Found in decomposing vegetation, soil, corn seeds and in flour. The species *Trichothecium roseum* can produce a trichothecene toxin that may be associated with disease in humans and other animals. Reported to be allergenic.

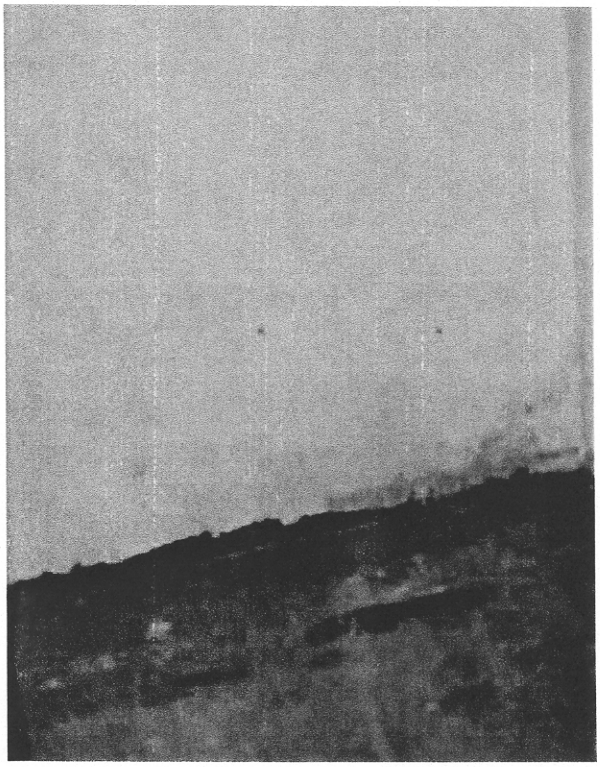
Ulocladium sp. - Isolated from dead plants and cellulose materials. Found on textiles.

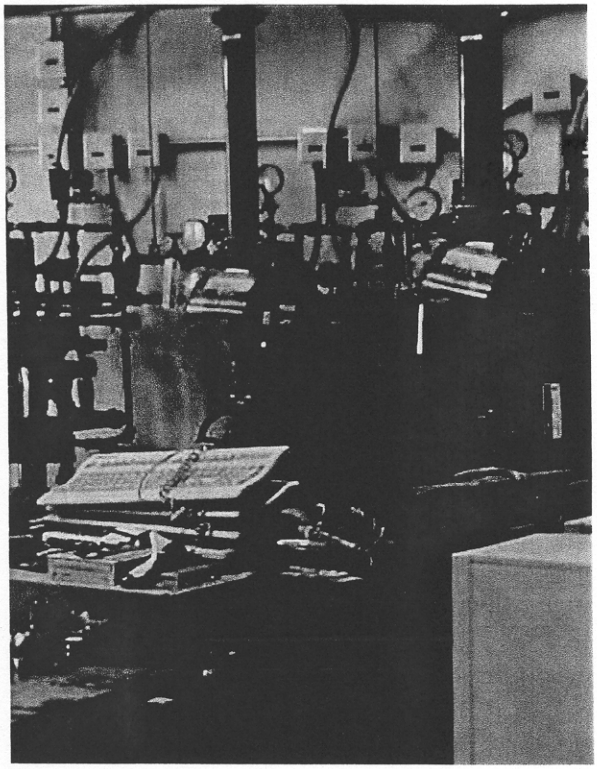
Yeast - Various yeasts are commonly identified on air samples. Some yeasts are reported to be allergenic. They may cause problems if a person has had previous exposure and developed hypersensitivity's. Yeasts may be allergenic to susceptible individuals when present in sufficient concentrations.

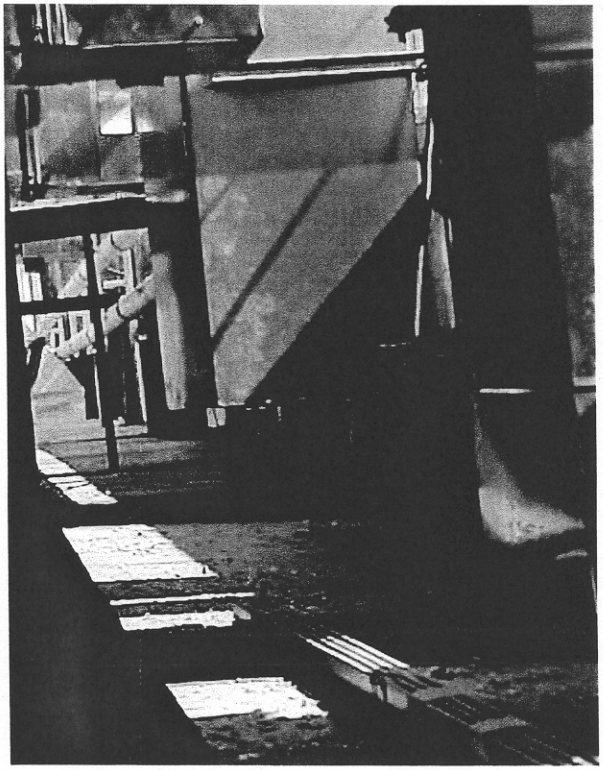
(Adapted from University of Minnesota, © 12/00 AESI)

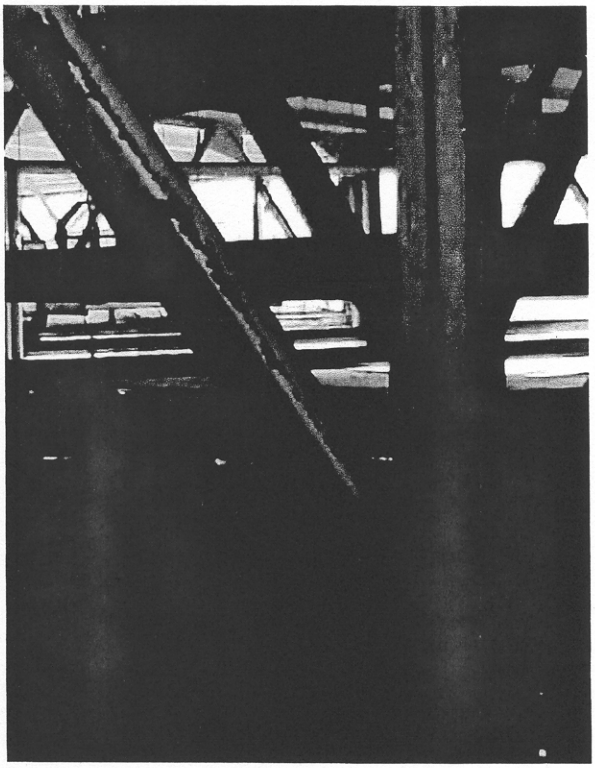


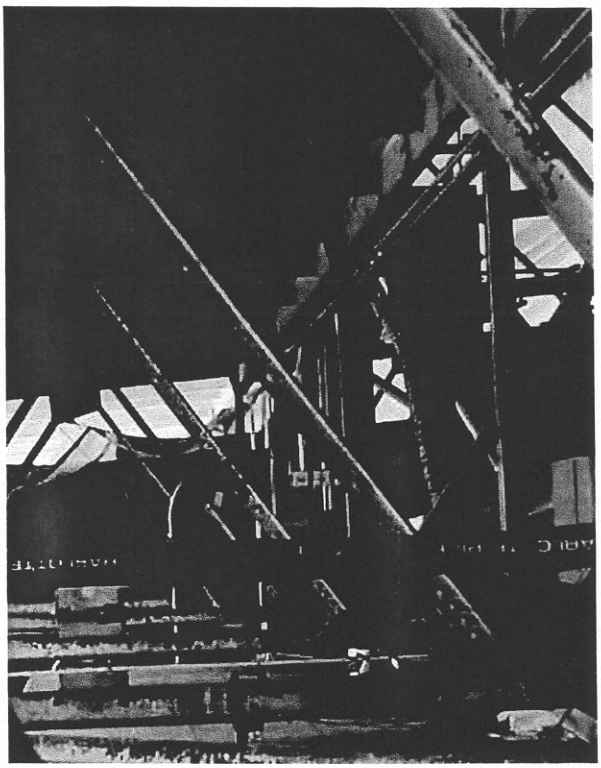


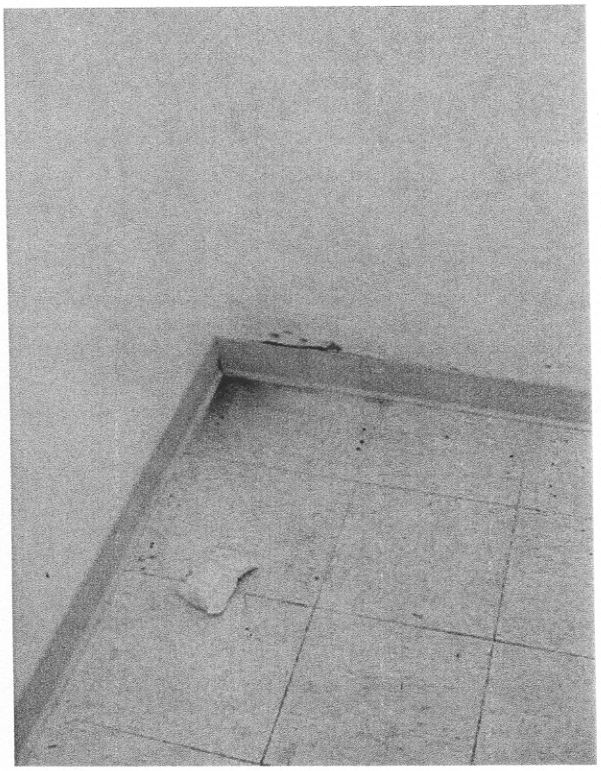


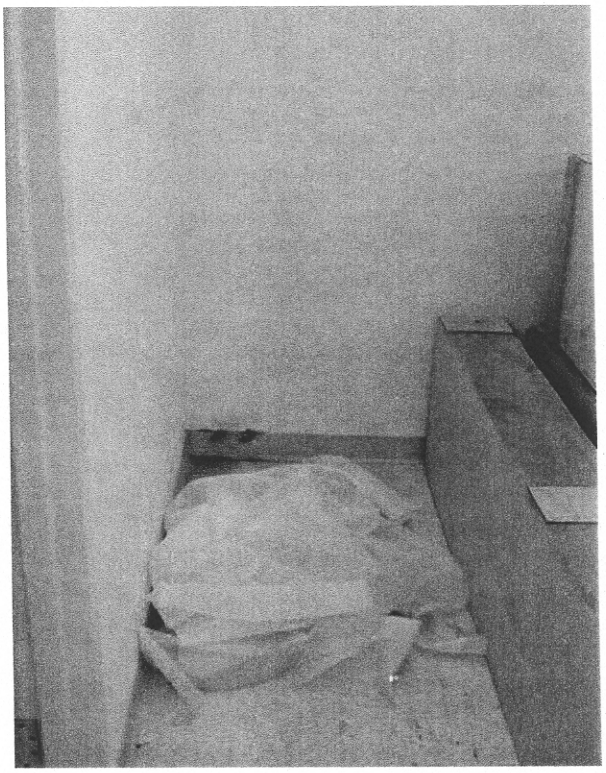


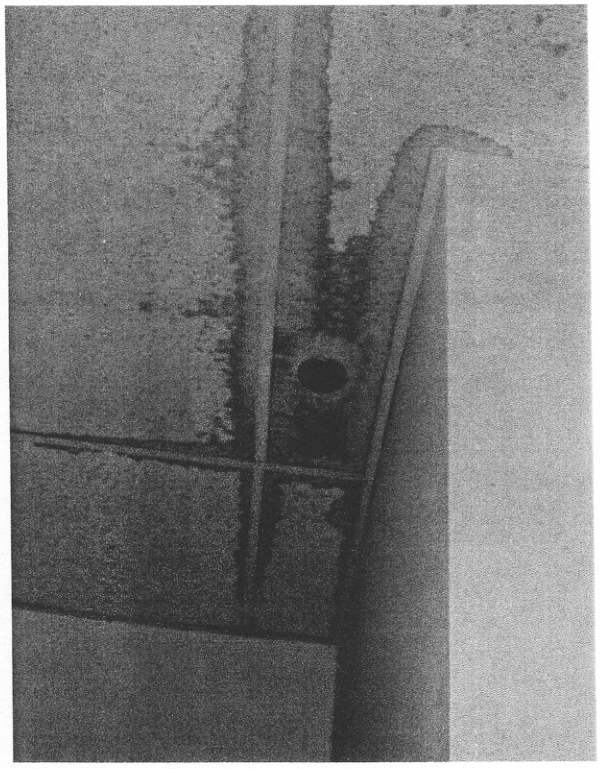


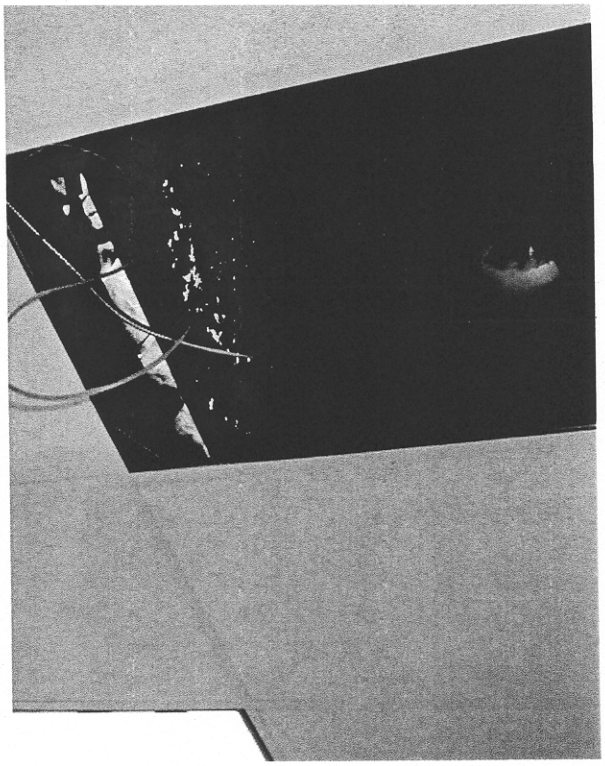


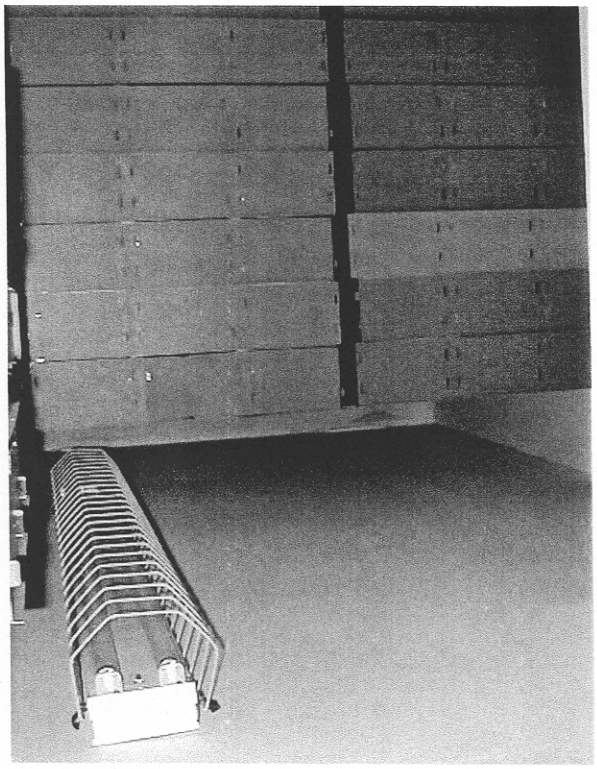


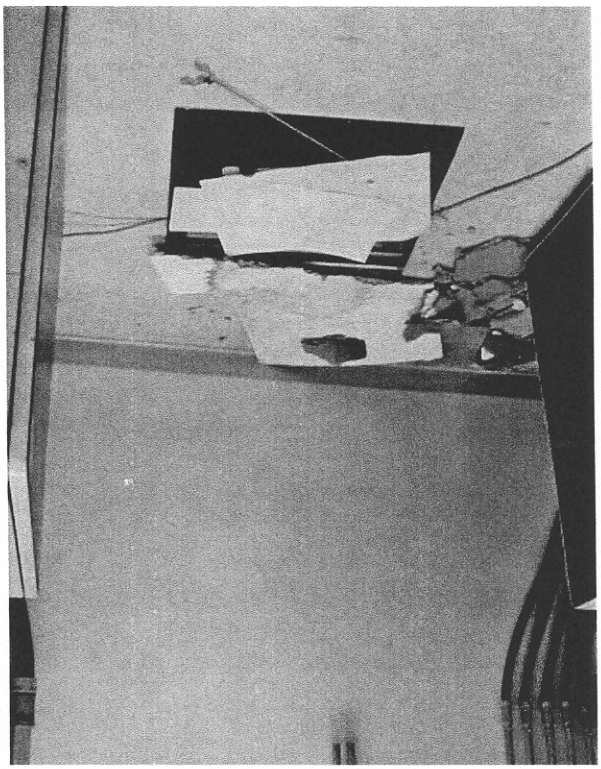


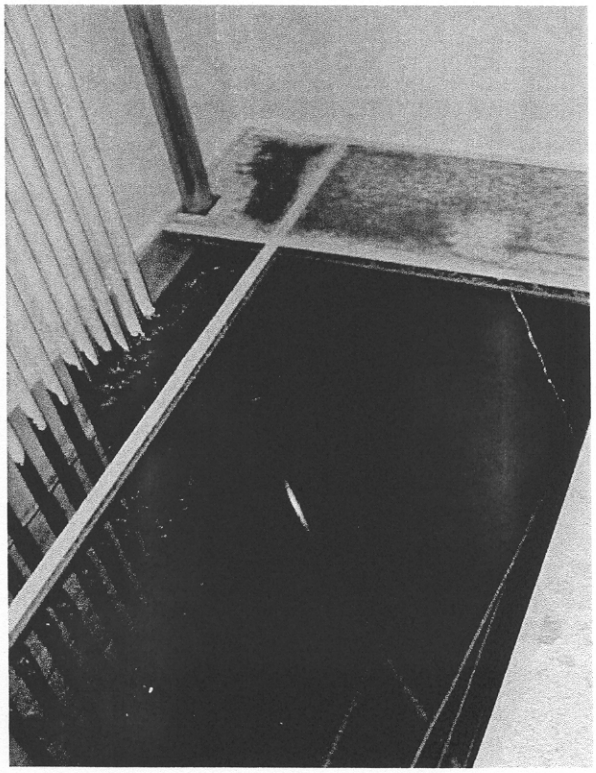


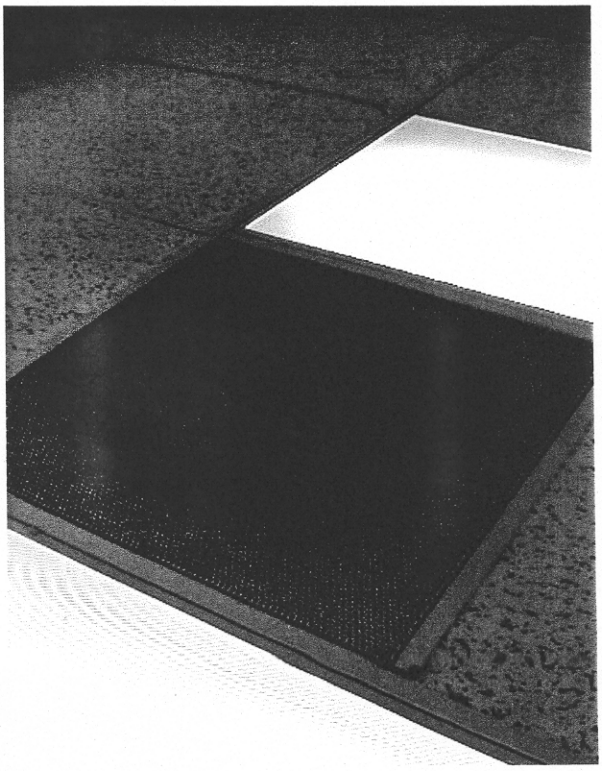


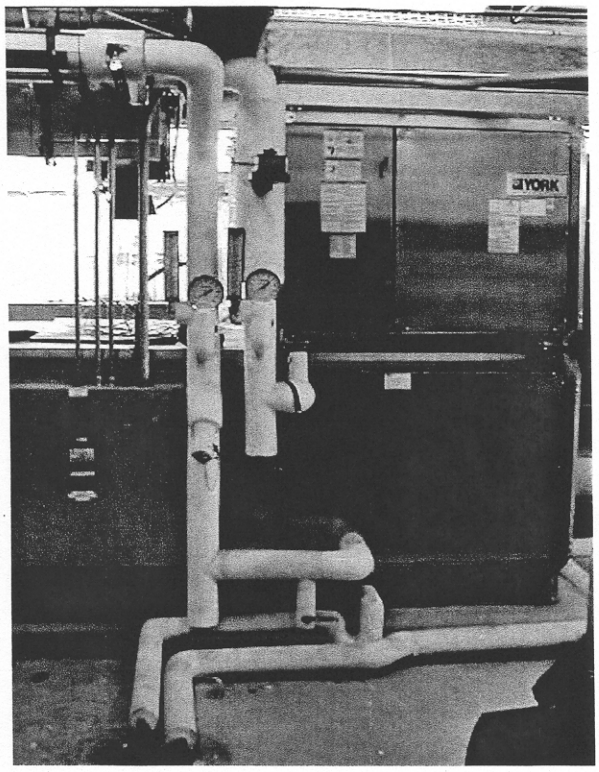








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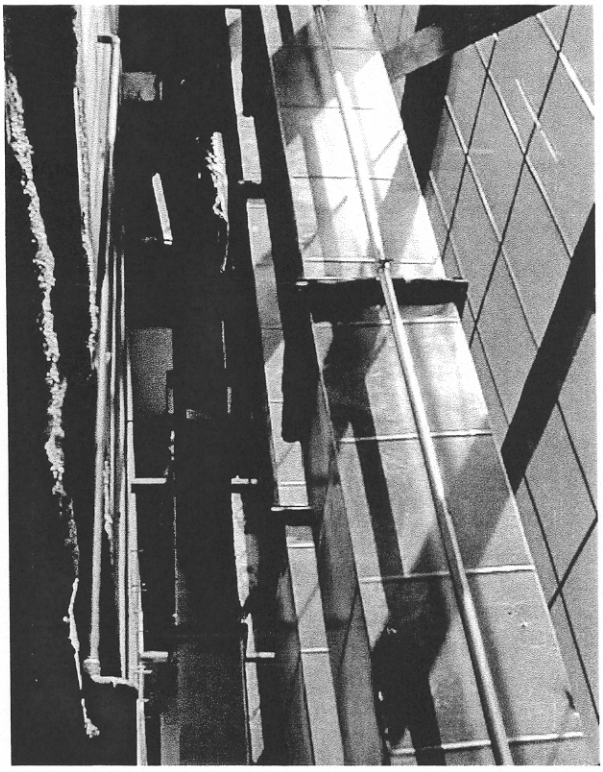

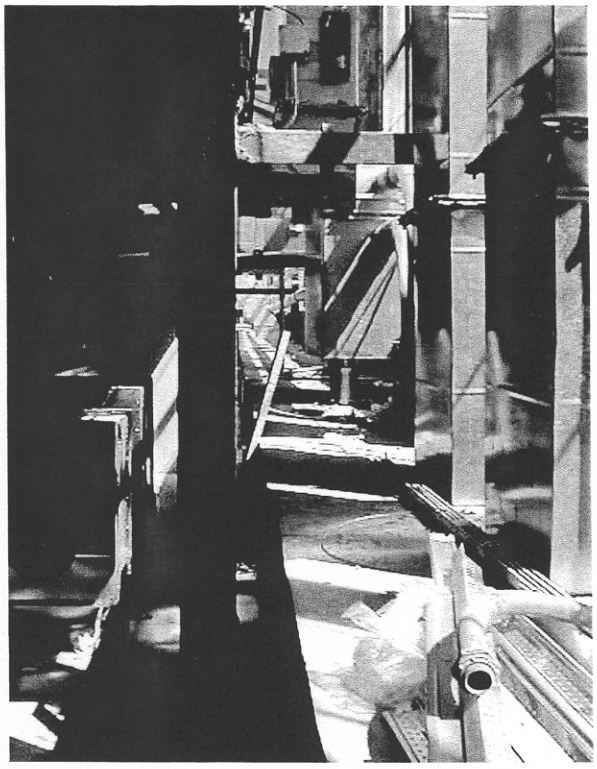

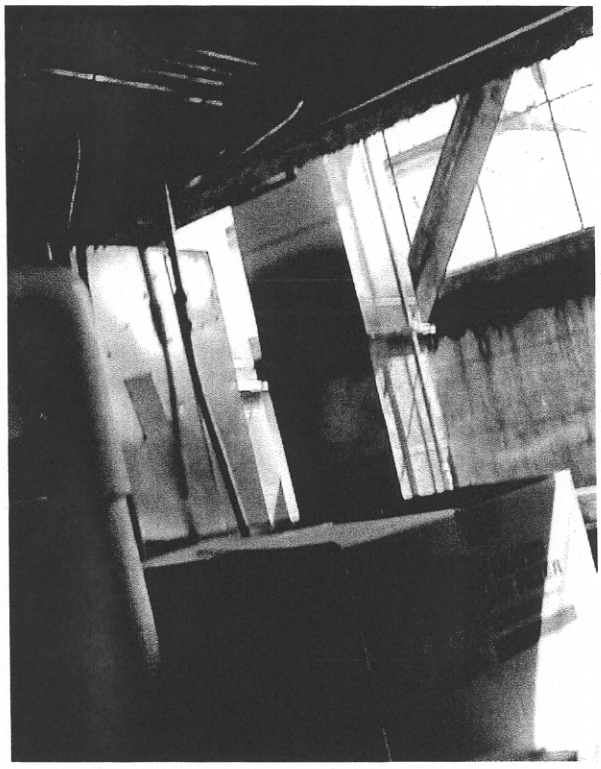

Appendix D

Selected Photographs – October 2000